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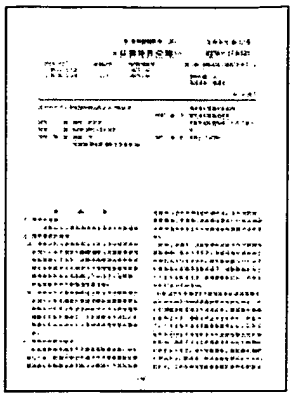

Title: COMPOSITE BOARD CONTAINING NATURAL VITREOUS EXPANDED BODY AND ITS MANUFACTURE

Abstract: PURPOSE: To manufacture a composite board contg. a natural vitreous expanded body and having a high heat insulating effect, nonflammability, water-tightness and high strength by laminating a fiber reinforced inorg. cured material on the surface of a platelike body composed of natural vitreous expanded granules.

CONSTITUTION: A hydrated inorg. curable material and reinforcing fibers are applied in the form of a slurry or paste to at least one surface of a platelike body 1 composed of natural vitreous expanded granules 3 of obsidian or the like, and the curable material is cured to laminate a fiber reinforced inorg. cured material 2 extending from the interface between it and the platelike body 1 to the intergranular voids 4 of the granule 3pt. Thus, a composite board contg. a natural vitreous expanded body is manufactured. The platelike body 1 is obtd. by expanding fine grains of obsidian, perlite or the like by heating and by melting and self-bonding the expanded grains. Cement, gypsum, dolomite, magnesium carbonate or the like is used as the inorg. curable material, and glass fibers, asbestos, carbon fibers, metallic fibers or synthetic fibers are used as the reinforcing fibers.

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(54) Natural glass-quality expanded-foam object composite panel and method of manufacture
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Specifications

In the following sections, supplementary words, phrases or clauses are inserted by the translator enclosed by braces { } for better understanding of readers.

1. Title of invention
Natural glass-quality expanded-foam object composite panel and method of manufacture

2. Scope of patent claiming (What is claimed is:)

(1) A natural glass-quality expanded-foam object composite panel characterized by that a fiber-reinforced inorganic hardened matter is laminated on at least one-side surface of a board-shaped object mainly consisting of natural glass-quality foamed particles, and the said inorganic hardened matter continuously lies astride from the interface with board-shaped object to inter-particle gap of natural glass-quality foamed particle section.

(2) A method of manufacturing a natural glass-quality expanded-foam object composite object characterized by that a water-containing unhardened inorganic hardening matter, in a slurry-like or paste-like form, is laminated, along with reinforcing fibers, on at least one-side surface of board-shaped object mainly consisting of natural glass-quality foamed particles, which is then hardened.

3. Detailed description of the invention
The current invention relates to a natural glass-quality expanded-foam object composite panel, or more specifically, a composite panel made of lamination of obsidian and other natural glass-quality expanded-foam object and a fiber-reinforced inorganic hardened matter, and the method of manufacturing the said composite panel. The invention intends to propose a composite panel which is provided with high heat insulation property, non-combustibility and waterproofness, and further, it is high in the strength, and the manufacturing method thereof.

Concerning obsidian, pearlstone and other natural glass-quality foam-molded matters, we could conventionally obtain only molded matters that are prone to water absorption and are low in the strength. Molded matters having bulk specific gravity of 0.25 or less, in particular, have not come to be utilized as a general-purpose thermal insulating material although they have many inter-particle gaps and a high heat insulation property.

To overcome such shortcomings of natural glass molded matter, several suggestions have been tried. For example, a water repellant resin is applied in order to enhance the waterproofness, and plywood and/or slates are laminated to make a composite material in order to enhance the strength. However, composite panels produced by such methods thus far are not desirable in the economy in addition to the complicated manufacture process, and further, none of them satisfies fire safety, durability and other factors when selecting adhesives and waterproof agent, and furthermore, there is no means to achieve sufficient reinforcing effect.

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To overcome such shortcomings of natural glass-quality light-weight molded matter, the inventor of this invention and others have earnestly continued discussion and study to have come to reach the current invention.

The purport of the current invention is a natural glass-quality expanded-foam object composite panel and the method of manufacturing the said panel characterized by that a fiber-reinforced inorganic hardened matter is laminated on at least one-side surface of board-shaped object mainly consisting of natural glass-quality foamed particles, and the said inorganic hardened matter continuously lies astride from the interface with board-shaped object to the inter-particle gap of natural glass-quality foamed particle section.

This composite panel has a high heat insulation property because it is composed of a board-shaped object of natural glass-quality foamed particles. Furthermore, the material's original non-combustibility cannot be marred because fiber-reinforced inorganic hardened matters are laminated and thus preventing water permeating through that plane. In the inorganic hardened matter, which is high in the strength due to the fiber reinforcement, in particular, the inorganic hardened matter and the board-shaped object of natural glass-quality foamed particles are integrated into a body firmly adhering to each other because the foamed particles continuously exist, lying astride inter-particle of foamed particles, and compared with things that are made through simple lamination, interlayer exfoliation does not occur and breakage is not likely to take place although the board-shaped object is relatively fragile,
and the folding strength for which the inorganic hardened matter layer is set to outer side
and the impact strength are remarkably enhanced.

To manufacture such composite panels, laminate, along with reinforcing fibers, a slurry-like or paste-like unhardened water-containing inorganic hardening matter on the face of the board-shaped object mainly consisting of natural glass-quality foamed particles, and then cure this.

In the above process, since the board-shaped object has high affinity with the water and unhardened hardening matter, the slurry-like or paste-like hardening matter flows and moves into the inter-particle gaps of easily board-shaped object, to be cured, firmly integrating both layers into one. Moreover, cement, gypsum and other inorganic hardening substances generally require water for hardening, but the water contained in a slurry-like or paste-like condition does not dehydrate, and such water is retained by the natural glass-quality foamed particles, which positively supply that water necessary for hardening.

Another important point in this method of manufacture is that great contractile force acts in the process of the hardening matter being cured. For this reason, if hardening matter is laminated, along with reinforcing fibers, on two end faces or four end faces that are positioned against one surface of the foamed-particle board-shaped object, for example, or on both surfaces and end faces, or all faces, and if they are hardened, then the hardening matter will fasten the foamed-particle board-shaped object while it is hardened. Therefore, in the composite panel produced through hardening, the foamed-particle board-shaped object enters a tensile fastened condition by the hardened matter, and the reinforcing effect of the fiber-reinforced hardened matter will be ever more enhanced.

Since this composite object has been made of firm integration of the foamed-particle board-shaped object and the fiber-reinforced inorganic hardened matter, it is possible to make it to a practically sufficient strength level as an insulation panel. However, if it is desired to make it even much higher strength level,

you should simply laminate the fiber reinforcing inorganic hardened matter on two end faces or four end faces that are positioned against at least one-side surface, and make a condition that the hardened matter is tensile-fastening the board-shaped object.

The board-shaped object that uses, as main material, the foamed particles that constitute this composite object is a result of obsidian, pearl stone and other powder particle object is heated and foamed and then self-fused, or a result of foamed particles adhered with water glass of other non-combustible adhesives, or the like.

For inorganic hardened matters or hardening matters, we can use curing agent including cement, gypsum, dolomite and magnesium carbonate. For reinforcing fibers, we can use glass fibers, asbestos, carbon fibers, metallic fiber or synthetic fibers, and in short fiber shape, mixing them in inorganic hardening matter slurry or paste, or textiles, and in long fiber shape, laying and mixing. {Original Japanese text is rather confused grammatically}

For the method of laminating inorganic hardening matters on a foamed-particle board-shaped object, we can select some method, for example, apply hardening matter slurry or paste in which reinforcing fibers are mixed on the face of board-shaped object, or inject the said slurry or paste in the form in advance □, and place a board-shaped object on the top, apply pressure (0.5 to 1.0kg/cm^2 or so) as necessary, and remove the product from the form after curing.
It is a matter of course that we can adjust the water content in the slurry or paste according to the conditions, or make them half-dried, control the fluidity, and can control the degree of immersion of the board-shaped object into inter-particle gaps.

The fiber-reinforced hardened matter layer that constitutes this composite panel should have a thickness that is normally 1/ (10 to 20) or so of the thickness of foamed-particle board-shaped object, which ensures the purpose of the current invention to be achieved.

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The current invention is as described above, and it enables {manufacture} of composite panels having high heat insulating performance, fire resistance, non-combustibility, and further, high strength.

The following description uses embodiment cases.

Obsidian particles obtained from Wadamisaki {name of coastal area near Kobe} (particle size of 1 to 2mm) were heated, foamed, and fused in the form, producing a board-shaped object 1 (200 x 200 x 50mm) with the density being 0.15g/cm^3. Mortar consisting of white-colored cement (100 weight parts), silica sand (particle size 0.1 to 0.5mm, 60 weight parts), water 35 parts and alkali-resisting glass fiber chopped strand (fiber length 37mm) were simultaneously sprayed on one-side surface and four end faces of this board-shaped object 1 in order to smoothen the surface, and the object was left at the room temperature for 28 days for curing, to form a layer of fiber reinforcing inorganic hardening matter 2 with the thickness 5mm, thus producing a composite panel. The hardened matter 2 of this composite panel continuously lay astride in the inter-particle gap 4 of foamed particles 3 from the interface with the board-shaped object 1.

The physical properties of composite panel of this embodiment are shown in the table below. Also the physical properties of board-shaped object 1 in which foamed particles were fused are shown as Comparative Case.

Physical properties	Embodiment	Comparative Case
	Composite panel	Foamed-particle board-shaped object
Apparent specific gravity	0.35	0.15
Impact strength	1.0 kg·m	0.1 kg·m
Water permeability (24kg??)	10 ml	∞
Thermal conductivity	0.06 Kcal/mH°C	0.05

4. Simple description of a drawing

The drawings is an oblique perspective view of the composite panel of embodiment, partly showing a cross section.
1.....Board-shaped object consisting of natural glass-quality inorganic substance
2.....Fiber-reinforced inorganic hardening matter
3.....Natural glass-quality foamed particles
4.....Foamed particles inter-particle gap

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JP58110443ACOMPOSITE BOARD CONTAINING NATURAL VITREOUS EXPANDED BODY AND ITS MANUFACTURE

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Inventor: ***WATABE KAZUTAKA***

Publication Date: 1983-07-01
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